APPLICATION OF CHLOROPICRIN + 1,3 DICHLOROPROPENE THROUGH SOIL INJECTION IN NORTHERN ITALY

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Soil fumigation with methyl bromide (MB) is a common practice for the control of many soilborne pathogens in Italy. However recent restrictions are stimulating the application of new fumigants in Italy, generally characterised by a narrower spectrum of activity. Among possible alternatives, 1,3 dichloropropene (1,3D) has been taken into consideration: this fumigant, already registered in Italy for application in broadcast fumigation, is very active against nematodes in sandy soils (Tacconi and Ambrogioni, 1995) and only slightly effective against soil borne pathogens. In order to broaden its spectrum of activity, a mixture of 1,3D + chloropicrin [Telone C-35- Dow AgroSciences, chloropicrin (PIC) 35% + 1,3D 61%] is under registration in Italy. The effectiveness of the mixture was evaluated at Albenga (Liguria Region – Northern Italy) carrying out one trial, in open field conditions, aimed at studying the effectiveness of the mixture against several soil borne pathogens and to compare the effect of PIC+1,3D with that of MB. The distribution of the product was carried out by injection, using an equipment similar to the system used for MB injection, able to mulch the soil making beds 80 cm large and 10 cm high. Soil was mulched with a polyethylene (Eiffel - Fontanellato Parma, Italy 0.05 mm thick) or a gas impermeable (VIF – IPM Mondovì Italy 0.035 mm thick, permeability coefficient to MB 0.02 g/m^{2}xh NFT54-195) films.

The results obtained against *R. solani, F. lycopersici, P. capsici, V. dahliae and S. sclerotiorum,* directly exposed to the fumigant, applied at 4 dosages (7+12.2 g/m^2, 10.5+18.3 g/m^2, 14+24.4 g/m^2, 17.5+30.5 g/m^2), as artificially propagated mycelium, or spores or sclerotia, placed at different depths in the soil, using a technique already described (Minuto *et al*., 1998) are reported.

Against *P.capsici* (table 1) the fumigation with the mixture PIC+1,3D under PE at dosage 3 and 4 or under VIF at dosage 1 and 2 gave the same results of MB applied at higher dosage PE or lower dosage VIF. At 20 cm depth only the fumigation with PIC+1,3D under VIF permitted to obtain results similar to MB.

Against *F. lycopersici* (table 1) at 10 cm depth, only the application of PIC+1,3D at dosage 4 under PE or at dosage 2 under VIF gave results similar to MB. At 20 cm depth the fumigation with PIC+1,3D at dosage 1 and 2 under VIF was as effective as MB.

Against *R. solani* (table 2), at 10 cm depth, good results was obtained by fumigation with PIC+1,3D at dosage 3 under PE and dosage 1 and 2 under VIF. At 20 cm depth all treatments gave good efficacy, except the application of dosage 1 of PIC+1,3D under PE.

Against *S. sclerotiorum* at 10 cm depth the application of PIC+1,3D was effective only under PE (table 2).

Against *V. dahliae*, at 10 cm depth PIC+1,3D applied at dosage 4 under PE provided results similar to MB application and at 20 cm depth any treatment was similar to MB, even if the application of PIC+1,3D at dosage 4 under PE and dosage 2 under VIF gave differed from the control.

Altogether the results confirm the excellent efficacy of MB and highlight a good effectiveness for the mixture PIC+1,3D against *P. capsici and R. solani,* at 14+24.4 and 17.5+30.5 g a.i./ m^2 under PE and at 10.5+18.3 g a.i./ m^2 under VIF against *F. lycopersici*. The effect of the fumigant mixture against *V. dahliae* was only moderate at 17.5+30.5 g. a.i./ m^2 under PE and at 10.5+18.3 g a.i./ m^2 under VIF. In conclusion the mixture of PIC+1,3D can represent an efficient alternative to MB, even if weeds are not controlled (Winterbottom *et al*., 1999). Moreover the data suggest the possibility to improve the efficacy of PIC+1,3D by applying the mixture under VIF films: this technique permits to reduce the dosage of application and the fumigant smell, particularly for application carried out near houses.

References

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Table 1 – Effect of fumigation on the survival of soil buried pathogens.

PIC+1,3D dosage	Fumigant, g a.i. /m^2, plastic mulch	% of kernels infected with			
		Phytophthora capsici		*Fusarium oxysporum* f.sp.*lycopersici*	
		at depth of			
		10 cm	20 cm	10 cm	20 cm
1	PIC+1,3D, 7+12.2, PE^	47 c*	50 d	100 e	100 b
2	PIC+1,3D, 10.5+18.3, PE	24 b	28 c	53 d	100 b
3	PIC+1,3D, 14+24.4, PE	7 a	23 bc	46 cd	100 b
4	PIC+1,3D, 17.5+30.5, PE	8 a	19 abc	19 abc	84 b
-	MB°, 58.8, PE	1 a	2 a	16 abc	12 a
1	PIC+1,3D, 7+12.2, VIF^^	10 a	13 abc	42 bcd	100 b
2	PIC+1,3D, 10.5+18.3, VIF	5 a	9 ab	11 ab	22 a
-	MB, 39.2, VIF	2 a	4 a	3 a	15 a
-	Control	76 d	62 d	100 e	100 b

***** Means of the same column followed by the same letter do not statistically differ following Duncan's Multiple Range Test (P =0.05).

° MB: Metabrom98, methyl bromide 98% + PIC 2%.

^ PE: polyethylene made by Eiffel - Fontanellato Parma, Italy 0.05 mm thick.

^^ VIF: virtually impermeable film made by IPM Mondovì Italy 0.035 mm thick, permeability coefficient to MB 0.02 g/m^2xh NFT54-195) films.

Table 2 - Effect of fumigation on the survival of soil buried pathogens.

PIC+1,3D dosage	Fumigant, g a.i. /m^2, plastic mulch	% of kernels infected with					
		Rhizoctonia solani		*Sclerotinia sclerotiorum*		*Verticillium dahliae*	
		at depth of					
		10 cm	20 cm	10 cm	20 cm	10 cm	20 cm
1	PIC+1,3D, 7+12.2, PE^	35 c*	16 b	87 de	69 c	95 b*	96 c
2	PIC+1,3D, 10.5+18.3, PE	30 c	8 ab	55 cd	50 bc	91 b	88 bc
3	PIC+1,3D, 14+24.4, PE	19 ab	7 ab	10 ab	5 ab	77 b	73 bc
4	PIC+1,3D, 17.5+30.5, PE	26 bc	13 ab	6 a	15 ab	49 a	65 b
-	MB°, 58.8, PE	4 a	6 ab	1 a	1 a	37 a	35 a
1	PIC+1,3D, 7+12.2, VIF^^	12 ab	9 ab	71 cde	80 c	82 b	81 bc
2	PIC+1,3D, 10.5+18.3, VIF	9 a	6 ab	43 bc	20 ab	72 b	66 b
-	MB, 39.2, VIF	6 a	3 a	12 ab	9 ab	38 a	41 a
-	Control	65 d	46 c	91 e	75 c	95 b	93 c

*, °, ^, ^^ see table 1